

Virginia Administrative Code
Title 12. Health
Agency 5. Department of Health
Chapter 481. Virginia Radiation Protection Regulations

12VAC5-481-1170. Purpose.

Part V. Radiation Safety Requirements For Industrial Radiographic Operations

Article 1. General Requirements

This part prescribes requirements for the issuance of licenses or registrations for the industrial use of sources of radiation and radiation safety requirements for persons using these sources of radiation in industrial radiography.

12VAC5-481-1180. Scope.

The provisions and requirements of this part are in addition to, and not in substitution for, other requirements of these regulations. In particular, the general requirements and provisions of Parts I ([12VAC5-481-10](#) et seq.); II ([12VAC5-481-260](#) et seq.); III ([12VAC5-481-380](#) et seq.); IV ([12VAC5-481-600](#) et seq.); X ([12VAC5-481-2250](#) et seq.) and XIII ([12VAC5-481-2950](#) et seq.), of this chapter apply to applicants, licensees and registrants subject to this part. Parts III ([12VAC5-481-380](#) et seq.) and XIII ([12VAC5-481-2950](#) et seq.) of this chapter apply to licensing and transportation of radioactive material and Part II ([12VAC5-481-260](#) et seq.) of this chapter applies to the registration of radiation machines. Except for sections that are applicable only to sealed radioactive sources, radiation machines and sealed radioactive sources are both covered by this part. This regulation does not apply to medical uses of sources of radiation that are addressed in Parts VII ([12VAC5-481-1660](#) et seq.) and XV ([12VAC5-481-3380](#) et seq.) of this chapter.

12VAC5-481-1190. Exemptions.

A. Uses of certified and certifiable cabinet X-ray systems are exempt from the requirements of this part except for [12VAC5-481-1200](#) and the following:

1. For certified and certifiable cabinet X-ray systems, including those designed to allow admittance of individuals:
 - a. No registrant shall permit any individual to operate a cabinet X-ray system until the individual has received a copy of and instruction in the operating procedures for the unit. Records that demonstrate compliance with this subdivision shall be maintained for agency inspection until disposal is authorized by the agency.
 - b. Tests for proper operation of interlocks must be conducted and recorded at intervals not to exceed six months. Records of these tests shall be maintained for agency inspection until disposal is authorized by the agency.
 - c. The registrant shall perform an evaluation of the radiation dose limits to determine

compliance with [12VAC5-481-720](#) and 21 CFR 1020.40, Cabinet X-ray Systems, at intervals not to exceed one year. Records of these evaluations shall be maintained for agency inspection for two years after the evaluation.

2. Certified cabinet X-ray systems shall be maintained in compliance with 21 CFR 1020.40, Cabinet X-ray Systems, and no modification shall be made to the system unless prior agency approval has been granted.

B. Industrial uses of hand-held light intensified imaging devices are exempt from the requirements of exceed 0.2 mSv (2 mrem) per hour. Devices that exceed this limit shall meet the applicable requirements of this part and the licensing or registration requirements of Part II ([12VAC5-481-260](#) et seq.) or Part III ([12VAC5-481-380](#) et seq.) of this chapter, as applicable.

12VAC5-481-1200. Licensing and Registration Requirements for Industrial Radiography Operations.

A. The agency will approve an application for a specific license for the use of licensed material or a registration for use of radiation machines if the applicant meets the following requirements:

1. The applicant satisfies the general requirements specified in Part II ([12VAC5-481-260](#) et seq.) for radiation machine facilities or Part III ([12VAC5-481-380](#) et seq.) for radioactive material, as applicable, and any special requirements contained in this part;
2. The applicant submits an adequate program for training radiographers and radiographer's assistants that meets the requirements of [12VAC5-481-1320](#);
3. The applicant submits procedures for verifying and documenting the certification status of radiographers and for ensuring that the certification of individuals acting as radiographers remains valid;
4. The applicant submits written operating and emergency procedures as described in [12VAC5-481-1330](#);
5. The applicant submits a description of a program for inspections of the job performance of each radiographer and radiographer's assistant at intervals not to exceed six months as described in [12VAC5-481-1320](#) E;
6. The applicant submits a description of the applicant's overall organizational structure as it applies to the radiation safety responsibilities in industrial radiography, including specified delegation of authority and responsibility;
7. The applicant submits the qualifications of the individual(s) designated as the radiation safety officer as described in [12VAC5-481-1310](#) A 1;
8. If an applicant intends to perform leak testing of sealed sources or exposure devices containing depleted uranium (DU) shielding, the applicant must describe the procedures for performing the test. The description must include the:

- a. Methods of collecting the samples;
- b. Qualifications of the individual who analyzes the samples;
- c. Instruments to be used; and
- d. Methods of analyzing the samples;

9. If the applicant intends to perform calibrations of survey instruments and alarming ratemeters, the applicant must describe methods to be used and the experience of the person(s) who will perform the calibrations. All calibrations must be performed according to the procedures described and at the intervals prescribed in [12VAC5-481-1240](#) and [12VAC5-481-1350](#) G 4;

10. The applicant identifies and describes the location(s) of all field stations and permanent radiographic installations;

11. The applicant identifies the location(s) where all records required by this and other parts of these regulations will be maintained;

12. If a license application includes underwater radiography, a description of:

- a. Radiation safety procedures and radiographer responsibilities unique to the performance of underwater radiography;
- b. Radiographic equipment and radiation safety equipment unique to underwater radiography; and
- c. Methods for gas-tight encapsulation of equipment; and

13. If an application includes offshore platform and/or lay-barge radiography, a description of:

- a. Transport procedures for radioactive material to be used in industrial radiographic operations;
- b. Storage facilities for radioactive material; and
- c. Methods for restricting access to radiation areas.

B. A license or registration will be issued if the requirements of subsection A of this section, as applicable, are met.

12VAC5-481-1210. Performance Requirements for Industrial Radiography Equipment.

A. Equipment used in industrial radiographic operations must meet the following minimum criteria:

Each radiographic exposure device, source assembly or sealed source, and all associated equipment must meet the requirements specified in American National Standard Institute, N432-1980 "Radiological Safety for the Design and Construction of Apparatus for Gamma

Radiography," (published as NBS Handbook 136, issued January 1981);

B. In addition to the requirements specified in this section the following requirements apply to radiographic exposure devices, source changers, source assemblies and sealed sources;

1. The licensee shall ensure that each radiographic exposure device has attached to it a durable, legible, clearly visible label bearing the:

- a. Chemical symbol and mass number of the radionuclide in the device;
- b. Activity and the date on which this activity was last measured;
- c. Model or product code and serial number of the sealed source;
- d. Name of the manufacturer of the sealed source; and
- e. Licensee's name, address, and telephone number.

2. Radiographic exposure devices intended for use as Type B packages must meet the applicable transportation requirements of Part XIII ([12VAC5-481-2950](#) et seq.) of this chapter.

3. Modification of radiographic exposure devices, source changers, and source assemblies and associated equipment is prohibited, unless approved by the agency or other approval body.

C. In addition to the requirements specified in subsections A and B of this section, the following requirements apply to radiographic exposure devices, source assemblies, and associated equipment that allow the source to be moved out of the device for radiographic operations or to source changers;

1. The coupling between the source assembly and the control cable must be designed in such a manner that the source assembly will not become disconnected if cranked outside the guide tube. The coupling must be such that it cannot be unintentionally disconnected under normal and reasonably foreseeable abnormal conditions.
2. The device must automatically secure the source assembly when it is cranked back into the fully shielded position within the device. This securing system may only be released by means of a deliberate operation on the exposure device.
3. The outlet fittings, lock box, and drive cable fittings on each radiographic exposure device must be equipped with safety plugs or covers that must be installed during storage and transportation to protect the source assembly from water, mud, sand or other foreign matter.
4. Each sealed source or source assembly must have attached to it or engraved on it, a durable, legible, visible label with the words:

"DANGER—RADIOACTIVE."

The label may not interfere with the safe operation of the exposure device or associated equipment.

5. The guide tube must be able to withstand a crushing test that closely approximates the crushing forces that are likely to be encountered during use, and be able to withstand a kinking resistance test that closely approximates the kinking forces that are likely to be encountered during use.
6. Guide tubes must be used when moving the source out of the device.
7. An exposure head or similar device designed to prevent the source assembly from passing out of the end of the guide tube must be attached to the outermost end of the guide tube during industrial radiography operations.
8. The guide tube exposure head connection must be able to withstand the tensile test for control units specified in ANSI N432-1980.
9. Source changers must provide a system for ensuring that the source will not be accidentally withdrawn from the changer when connecting or disconnecting the drive cable to or from a source assembly.

D. All radiographic exposure devices and associated equipment in use after January 10, 1996, must comply with the requirements of this section; and

E. As an exception to subsection A of this section, equipment used in industrial radiographic operations need not comply with 8.9.2(c) of the Endurance Test in American National Standards Institute N432-1980, if the prototype equipment has been tested using a torque value representative of the torque that an individual using the radiography equipment can reasonably exert on the lever or crankshaft of the drive mechanism.

12VAC5-481-1220. Limits on External Radiation Levels from Storage Containers and Source Changers.

The maximum exposure rate limits for storage containers and source changers are 2 mSv (200 mrem) per hour at any exterior surface, and 0.1 mSv (10 mrem) per hour at one meter from any exterior surface with the sealed source in the shielded position.

12VAC5-481-1230. Locking of Sources of Radiation, Storage Containers and Source Changers.

A. Each radiographic exposure device must have a lock or outer locked container designed to prevent unauthorized or accidental removal of the sealed source from its shielded position. The exposure device and/or its container must be kept locked, and if a keyed-lock, with the key removed at all times, when not under the direct surveillance of a radiographer or a radiographer's assistant except at permanent radiographic installations as stated in [12VAC5-481-1370](#) . In addition, during radiographic operations the sealed source assembly must be secured in the shielded position each time the source is returned to that position.

B. Each sealed source storage container and source changer must have a lock or outer locked container designed to prevent unauthorized or accidental removal of the sealed source from its shielded position. Storage containers and source changers must be kept locked, and if a

keyed-lock, with the key removed at all times, when containing sealed sources except when under the direct surveillance of a radiographer or a radiographer's assistant.

C. The control panel of each radiation machine shall be equipped with a lock that will prevent the unauthorized use of an X-ray system or the accidental production of radiation. The radiation machine shall be kept locked and the key removed at all times except when under the direct visual surveillance of a radiographer or a radiographer's assistant.

12VAC5-481-1240. Radiation Survey Instruments.

A. The licensee or registrant shall keep sufficient calibrated and operable radiation survey instruments at each location where sources of radiation are present to make the radiation surveys required by this part and by Part IV ([12VAC5-481-600](#) et seq.) of this chapter. Instrumentation required by this section must be capable of measuring a range from 0.02 mSv (2 mrem) per hour through 0.01 Sv (1 rem) per hour.

B. The licensee or registrant shall have each radiation survey instrument required under subsection A of this section calibrated:

1. At energies appropriate for use and at intervals not to exceed six months or after instrument servicing, except for battery changes;
2. For linear scale instruments, at two points located approximately one-third and two-thirds of full-scale on each scale; for logarithmic scale instruments, at mid-range of each decade, and at two points of at least one decade; and for digital instruments, at three points between 0.02 and 10 mSv (2 and 1000 mrem) per hour; and
3. So that an accuracy within plus or minus 20% of the true radiation dose rate can be demonstrated at each point checked.

C. The licensee or registrant shall maintain records of the results of the instrument calibrations in accordance with [12VAC5-481-1410](#).

12VAC5-481-1250. Leak Testing and Replacement of Sealed Sources.

A. The replacement of any sealed source fastened to or contained in a radiographic exposure device and leak testing of any sealed source must be performed by persons authorized to do so by the agency, the NRC, or another agreement state.

B. The opening, repair, or modification of any sealed source must be performed by persons specifically authorized to do so by the agency, the NRC, or another agreement state.

C. Testing and recordkeeping requirements.

1. Each licensee who uses a sealed source shall have the source tested for leakage at intervals not to exceed six months. The leak testing of the source must be performed using a method approved by the agency, the NRC, or by another agreement state. The wipe sample should be taken from the nearest accessible point to the sealed source where contamination might accumulate. The wipe sample must be analyzed for radioactive contamination. The analysis must be capable of detecting the presence of 185 Bq (0.005

μCi) of radioactive material on the test sample and must be performed by a person specifically authorized by the agency, the NRC, or another agreement state to perform the analysis.

2. The licensee shall maintain records of the leak tests in accordance with [12VAC5-481-1420](#) .

3. Unless a sealed source is accompanied by a certificate from the transferor that shows that it has been leak tested within six months before the transfer, it may not be used by the licensee until tested for leakage. Sealed sources that are in storage and not in use do not require leak testing, but must be tested before use or transfer to another person if the interval of storage exceeds six months.

D. Any test conducted pursuant to subsections B and C of this section that reveals the presence of 185 Bq (0.005 μCi) or more of removable radioactive material must be considered evidence that the sealed source is leaking. The licensee shall immediately withdraw the equipment involved from use and shall have it decontaminated and repaired or disposed of in accordance with agency regulations. A report must be filed with the agency within five days of any test with results that exceed the threshold in this paragraph, describing the equipment involved, the test results, and the corrective action taken.

E. Each exposure device using depleted uranium (DU) shielding and an "S" tube configuration must be tested for DU contamination at intervals not to exceed 12 months. The analysis must be capable of detecting the presence of 185 Bq (0.005 μCi) of radioactive material on the test sample and must be performed by a person specifically authorized by the agency, the NRC, or another agreement state to perform the analysis. Should such testing reveal the presence of DU contamination, the exposure device must be removed from use until an evaluation of the wear of the S-tube has been made. Should the evaluation reveal that the S-tube is worn through, the device may not be used again. DU shielded devices do not have to be tested for DU contamination while not in use and in storage. Before using or transferring such a device, however, the device must be tested for DU contamination, if the interval of storage exceeds 12 months. A record of the DU leak test must be made in accordance with [12VAC5-481-1420](#) .

12VAC5-481-1260. Quarterly Inventory.

A. Each licensee or registrant shall conduct a quarterly physical inventory to account for all sources of radiation, and for devices containing depleted uranium received and possessed under the license.

B. The licensee or registrant shall maintain records of the quarterly inventory in accordance with [12VAC5-481-1430](#) .

12VAC5-481-1270. Inspection and Maintenance of Radiation Machines, Radiographic Exposure Devices, Transport and Storage Containers, Associated Equipment, Source Changers, and Survey Instruments.

A. The licensee or registrant shall perform visual and operability checks on survey meters, radiation machines, radiographic exposure devices, transport and storage containers,

associated equipment and source changers before each day's use, or work shift, to ensure that:

1. The equipment is in good working condition;
2. The sources are adequately shielded; and
3. Required labeling is present.

B. Survey instrument operability must be performed using check sources or other appropriate means.

C. If equipment problems are found, the equipment must be removed from service until repaired.

D. Each licensee or registrant shall have written procedures for and perform inspection and routine maintenance of radiation machines, radiographic exposure devices, source changers, associated equipment, transport and storage containers, and survey instruments at intervals not to exceed three months or before the first use thereafter to ensure the proper functioning of components important to safety. If equipment problems are found, the equipment must be removed from service until repaired. Replacement components shall meet design requirements.

E. The licensee's inspection and maintenance program must include procedures to assure that Type B packages are shipped and maintained in accordance with the certificate of compliance or other approval.

F. Records of equipment problems and of any maintenance performed under this section must be made in accordance with [12VAC5-481-1450](#).

12VAC5-481-1280. Permanent Radiographic Installations.

A. Each entrance that is used for personnel access to the high radiation area in a permanent radiographic installation must have either:

1. An entrance control of the type described in [12VAC5-481-780](#) that causes the radiation level upon entry into the area to be reduced; or
2. Both conspicuous visible and audible warning signals to warn of the presence of radiation. The visible signal must be actuated by radiation whenever the source is exposed or the machine is energized. The audible signal must be actuated when an attempt is made to enter the installation while the source is exposed or the machine is energized.

B. The alarm system must be tested for proper operation with a radiation source each day before the installation is used for radiographic operations. The test must include a check of both the visible and audible signals. Entrance control devices that reduce the radiation level upon entry as designated in subdivision A 1 of this section must be tested monthly. If an entrance control device or an alarm is operating improperly, it must be immediately labeled as defective and repaired within seven calendar days. The facility may continue to be used during this seven-day period, provided the licensee or registrant implements the continuous

surveillance requirements of [12VAC5-481-1370](#) and uses an alarming ratemeter. Test records for entrance controls and audible and visual alarms must be maintained in accordance with [12VAC5-481-1460](#).

12VAC5-481-1290. Labeling, Storage, and Transportation.

A. Licensees may not use a source changer or a container to store radioactive material unless the source changer or the storage container has securely attached to it a durable, legible, and clearly visible label bearing the standard trefoil radiation caution symbol conventional colors, i.e., magenta, purple, or black on a yellow background, having a minimum diameter of 25 mm, and the wording:

CAUTION *

RADIOACTIVE MATERIAL

NOTIFY CIVIL AUTHORITIES (or "NAME OF COMPANY")

* —or "DANGER"

B. Licensees may not transport radioactive material unless the material is packaged, and the package is labeled, marked, and accompanied with appropriate shipping papers in accordance with regulations set out in Part XIII ([12VAC5-481-2950](#) et seq.) of this chapter.

C. Radiographic exposure devices, source changers, storage containers, and radiation machines, shall be physically secured to prevent tampering or removal by unauthorized personnel. The licensee shall store radioactive material in a manner that will minimize danger from explosion or fire.

D. Licensees shall lock and physically secure the transport package containing radioactive material in the transporting vehicle to prevent accidental loss, tampering, or unauthorized removal.

12VAC5-481-1300. Conducting Industrial Radiographic Operations.

Article 2. Radiation Safety Requirements

A. Whenever radiography is performed at a location other than a permanent radiographic installation, the radiographer must be accompanied by at least one other qualified radiographer or an individual who has at a minimum met the requirements of [12VAC5-481-1320](#) C. The additional qualified individual shall observe the operations and be capable of providing immediate assistance to prevent unauthorized entry. Radiography may not be performed if only one qualified individual is present.

B. All radiographic operations must be conducted in a permanent radiographic installation unless otherwise specifically authorized by the agency.

C. Except when physically impossible, collimators shall be used in industrial radiographic operations that use radiographic exposure devices that allow the source to be moved out of the device.

D. A licensee or registrant may conduct lay-barge, offshore platform, or underwater radiography only if procedures have been approved by the agency, the NRC, or by another agreement state.

12VAC5-481-1310. Radiation Safety Officer.

A. The radiation safety officer shall ensure that radiation safety activities are being performed in accordance with approved procedures and regulatory requirements in the daily operation of the licensee's or registrant's program.

B. The minimum qualifications, training, and experience for radiation safety officers for industrial radiography are as follows:

1. Completion of the training and testing requirements of [12VAC5-481-1320](#) A;
2. 2000 hours of hands-on experience as a qualified radiographer in industrial radiographic operations; and
3. Formal training in the establishment and maintenance of a radiation protection program.

C. The agency will consider alternatives when the radiation safety officer has appropriate training and experience in the field of ionizing radiation, and in addition, has adequate formal training with respect to the establishment and maintenance of a radiation safety protection program.

D. The specific duties and authorities of the radiation safety officer include:

1. Establishing and overseeing all operating, emergency, and ALARA procedures as required by Part IV ([12VAC5-481-600](#) et seq.) of this chapter and reviewing them regularly to ensure that they conform to agency regulations and to the license or registration conditions;
2. Overseeing and approving the training program for radiographic personnel to ensure that appropriate and effective radiation protection practices are taught;
3. Ensuring that required radiation surveys and leak tests are performed and documented in accordance with the regulations, including any corrective measures when levels of radiation exceed established limits;
4. Ensuring that personnel monitoring devices are calibrated, if applicable, and used properly; that records are kept of the monitoring results; and that timely notifications are made as required by Part IV of this chapter; and
5. Ensuring that operations are conducted safely and for implementing corrective actions including terminating operations.

12VAC5-481-1320. Training.

A. The licensee or registrant may not permit any individual to act as a radiographer until the individual has received at least 40 hours of training in the subjects outlined in subsection G of

this section in addition to on the job training consisting of hands-on experience under the supervision of a radiographer and is certified through a radiographer certification program by a certifying entity meeting the requirements of 10 CFR Part 34, Appendix A. The on-the-job training shall include a minimum of two months (320 hours) of active participation in the performance of industrial radiography utilizing radioactive material and/or one month (160 hours) of active participation in the performance of industrial radiography utilizing radiation machines. Individuals performing industrial radiography utilizing radioactive materials and radiation machines must complete both segments of the on-the-job training (3 months or 480 hours).

B. In addition, the licensee or registrant may not permit any individual to act as a radiographer until the individual:

1. Has received copies of and instruction in the requirements described in the regulations contained in this part, [12VAC5-481-30](#) and applicable sections of Parts IV ([12VAC5-481-600](#) et seq.), X ([12VAC5-481-2250](#) et seq.), and XIII ([12VAC5-481-2950](#) et seq.) of this chapter, in the license or registration under which the radiographer will perform industrial radiography, and the licensee's or registrant's operating and emergency procedures;
2. Has demonstrated an understanding of items in subdivision 1 of this subsection by successful completion of a written examination;
3. Has received training in the use of the registrant's radiation machines, or the licensee's radiographic exposure devices, sealed sources, in the daily inspection of devices and associated equipment, and in the use of radiation survey instruments; and
4. Has demonstrated understanding of the use of the equipment described in subdivision 3 of this subsection by successful completion of a practical examination.

C. The licensee or registrant may not permit any individual to act as a radiographer's assistant until the individual:

1. Has received copies of and instruction in the requirements described in the regulations contained in this part, [12VAC5-481-30](#) and applicable sections of Parts IV ([12VAC5-481-600](#) et seq.), X ([12VAC5-481-2250](#) et seq.), and XIII ([12VAC5-481-2950](#) et seq.) of this chapter, in the license or registration under which the radiographer's assistant will perform industrial radiography, and the licensee's or registrant's operating and emergency procedures;
2. Has demonstrated an understanding of items in subdivision 1 of this subsection by successful completion of a written examination;
3. Under the personal supervision of a radiographer, has received training in the use of the registrant's radiation machines, or the licensee's radiographic exposure devices and sealed sources, in the daily inspection of devices and associated equipment, and in the use of radiation survey instruments; and
4. Has demonstrated understanding of the use of the equipment described in subdivision 3 of this subsection by successful completion of a practical examination.

D. The licensee or registrant shall provide annual refresher safety training for each radiographer and radiographer's assistant at intervals not to exceed 12 months.

E. Except as provided in subdivision 4 of this subsection, the RSO or designee shall conduct an inspection program of the job performance of each radiographer and radiographer's assistant to ensure that the agency's regulations, license or registration requirements, and operating and emergency procedures are followed. The inspection program must:

1. Include observation of the performance of each radiographer and radiographer's assistant during an actual industrial radiographic operation, at intervals not to exceed six months;
2. Provide that, if a radiographer or a radiographer's assistant has not participated in an industrial radiographic operation for more than six months since the last inspection, the radiographer must demonstrate knowledge of the training requirements of subdivision B 3 of this section and the radiographer's assistant must demonstrate knowledge of the training requirements of subdivision C 3 of this section by a practical examination before these individuals can next participate in a radiographic operation;
3. The agency may consider alternatives in those situations where the individual serves as both radiographer and radiation safety officer; and
4. In those operations where a single individual serves as both radiographer and radiation safety officer, and performs all radiography operations, an inspection program is not required;

F. The licensee or registrant shall maintain records of the above training to include certification documents, written and practical examinations, refresher safety training and inspections of job performance in accordance with [12VAC5-481-1470](#).

G. The licensee or registrant shall include the following subjects required in subsection A of this section:

1. Fundamentals of radiation safety including:
 - a. Characteristics of gamma and x-radiation;
 - b. Units of radiation dose and quantity of radioactivity;
 - c. Hazards of exposure to radiation;
 - d. Levels of radiation from sources of radiation; and
 - e. Methods of controlling radiation dose (time, distance, and shielding);
2. Radiation detection instruments including:
 - a. Use, operation, calibration, and limitations of radiation survey instruments;
 - b. Survey techniques; and
 - c. Use of personnel monitoring equipment;

3. Equipment to be used including:

- a. Operation and control of radiographic exposure equipment, remote handling equipment, and storage containers, including pictures or models of source assemblies (pigtailed);
- b. Operation and control of radiation machines;
- c. Storage, control, and disposal of sources of radiation; and
- d. Inspection and maintenance of equipment.

4. The requirements of pertinent state and federal regulations; and

5. Case histories of accidents in radiography.

12VAC5-481-1330. Operating and Emergency Procedures.

A. Operating and emergency procedures must include, as a minimum, instructions in the following:

1. Appropriate handling and use of sources of radiation so that no person is likely to be exposed to radiation doses in excess of the limits established in Part IV ([12VAC5-481-600](#) et seq.) of this chapter;
2. Methods and occasions for conducting radiation surveys;
3. Methods for posting and controlling access to radiographic areas;
4. Methods and occasions for locking and securing sources of radiation;
5. Personnel monitoring and the use of personnel monitoring equipment;
6. Transporting equipment to field locations, including packing of radiographic exposure devices and storage containers in the vehicles, placarding of vehicles when required, and control of the equipment during transportation as described in Part XIII ([12VAC5-481-2950](#) et seq.) of this chapter;
7. The inspection, maintenance, and operability checks of radiographic exposure devices, radiation machines, survey instruments, alarming ratemeters, transport containers, and storage containers;
8. Steps that must be taken immediately by radiography personnel in the event a pocket dosimeter is found to be off-scale or an alarming ratemeter alarms unexpectedly;
9. The procedure(s) for identifying and reporting defects and noncompliance, as required by [12VAC5-481-1530](#);
10. The procedure for notifying proper persons in the event of an accident or incident;
11. Minimizing exposure of persons in the event of an accident or incident, including a source disconnect, a transport accident, or loss of a source of radiation;

12. Source recovery procedure if licensee will perform source recoveries; and

13. Maintenance of records.

B. The licensee or registrant shall maintain copies of current operating and emergency procedures in accordance with [12VAC5-481-1480](#) and [12VAC5-481-1520](#).

12VAC5-481-1340. Supervision of Radiographer's Assistants.

The radiographer's assistant shall be under the personal supervision of a radiographer when using sources of radiation or conducting radiation surveys required by subdivision 2 of [12VAC5-481-1360](#) to determine that the sealed source has returned to the shielded position or the radiation machine is off after an exposure. The personal supervision must include:

1. The radiographer's physical presence at the site where the sources of radiation are being used;
2. The availability of the radiographer to give immediate assistance if required; and
3. The radiographer's direct observation of the assistant's performance of the operations referred to in this section.

12VAC5-481-1350. Personnel Monitoring.

A. The licensee or registrant may not permit any individual to act as a radiographer or a radiographer's assistant unless, at all times during radiographic operations, each individual wears, on the trunk of the body, a combination of direct reading dosimeter, an alarming ratemeter, and either a film badge, an optically stimulated luminescence (OSL) dosimeter or a thermoluminescent dosimeter (TLD). At permanent radiographic installations where other appropriate alarming or warning devices are in routine use, or during radiographic operations using radiation machines, the use of an alarming ratemeter is not required.

1. Pocket dosimeters must have a range from 0 to 2 mSv (200 mrem) and must be recharged at the start of each shift. Electronic personal dosimeters may only be used in place of ion-chamber pocket dosimeters.
2. Each film badge, OSL or TLD must be assigned to and worn by only one individual.
3. Film badges must be exchanged monthly. OSLs or TLDs must be exchanged at periods not to exceed three months.
4. After replacement, each film badge, OSL or TLD must be returned to the supplier for processing within 14 calendar days of the end of the monitoring period, or as soon as practicable. In circumstances that make it impossible to return each film badge, OSL or TLD in 14 calendar days, such circumstances must be documented and available for review by the agency.

B. Direct reading dosimeters, such as pocket dosimeters or electronic personal dosimeters, must be read and the exposures recorded at the beginning and end of each shift, and records must be maintained in accordance with [12VAC5-481-1490](#).

C. Pocket dosimeters, or electronic personal dosimeters, must be checked at periods not to exceed 12 months for correct response to radiation, and records must be maintained in accordance with [12VAC5-481-1490](#) . Acceptable dosimeters must read within plus or minus 20% of the true radiation exposure.

D. If an individual's pocket dosimeter is found to be off-scale, or the electronic personal dosimeter reads greater than 2 mSv (200 mrem), the individual's film badge, OSL or TLD must be sent for processing within 24 hours. In addition, the individual may not resume work associated with the use of sources of radiation until a determination of the individual's radiation exposure has been made. This determination must be made by the radiation safety officer or the radiation safety officer's designee. The results of this determination must be included in the records maintained in accordance with [12VAC5-481-1490](#) .

E. If a film badge, OSL or TLD is lost or damaged, the worker shall cease work immediately until a replacement film badge, OSL or TLD is provided and the exposure is calculated for the time period from issuance to loss or damage of the film badge, OSL or TLD. The results of the calculated exposure and the time period for which the film badge, OSL or TLD was lost or damaged must be included in the records maintained in accordance with [12VAC5-481-1490](#) .

F. Reports received from the film badge, OSL or TLD processor must be retained in accordance with [12VAC5-481-1490](#) .

G. Each alarming ratemeter must:

1. Be checked to ensure that the alarm functions properly before using at the start of each shift;
2. Be set to give an alarm signal at a preset dose rate of 5 mSv (500 mrem) per hour with an accuracy of plus or minus 20% of the true radiation dose rate;
3. Require special means to change the preset alarm function; and
4. Be calibrated at periods not to exceed 12 months for correct response to radiation. The licensee shall maintain records of alarming ratemeter calibrations in accordance with [12VAC5-481-1490](#) .

12VAC5-481-1360. Radiation Surveys.

The licensee or registrant shall:

1. Conduct all surveys with a calibrated and operable radiation survey instrument that meets the requirements of [12VAC5-481-1240](#);
2. Conduct a survey of the radiographic exposure device and the guide tube after each exposure when approaching the device or the guide tube. The survey must determine that the sealed source has returned to its shielded position before exchanging films, repositioning the exposure head, or dismantling equipment. Radiation machines shall be surveyed after each exposure to determine that the machine is off;
3. Conduct a survey of the radiographic exposure device whenever the source is exchanged

and whenever a radiographic exposure device is placed in a storage area, as defined in [12VAC5-481-10](#) , to ensure that the sealed source is in its shielded position; and

4. Maintain records in accordance with [12VAC5-481-1500](#) .

12VAC5-481-1370. Surveillance.

During each radiographic operation, the radiographer shall ensure continuous direct visual surveillance of the operation to protect against unauthorized entry into a radiation area or a high radiation area, as defined in Part I ([12VAC5-481-10](#) et seq.) of this chapter, except at permanent radiographic installations where all entryways are locked and the requirements of [12VAC5-481-1280](#) are met.

12VAC5-481-1380. Posting.

All areas in which industrial radiography is being performed must be conspicuously posted as required by [12VAC5-481-860](#) . The exceptions listed in [12VAC5-481-870](#) do not apply to industrial radiographic operations.

12VAC5-481-1390. Records for Industrial Radiography.

Article 3. Recordkeeping Requirements

Each licensee or registrant shall maintain a copy of its license or registration, documents incorporated by reference, and amendments to each of these items until superseded by new documents approved by the agency, or until the agency terminates the license or registration.

12VAC5-481-1400. Records of Receipt and Transfer of Sources of Radiation.

A. Each licensee or registrant shall maintain records showing the receipts and transfers of sealed sources, devices using DU for shielding, and radiation machines, and retain each record for three years after it is made.

B. These records must include the date, the name of the individual making the record, radionuclide, number of becquerels (curies) or mass (for DU), and manufacturer, model, and serial number of each source of radiation and/or device, as appropriate.

12VAC5-481-1410. Records of Radiation Survey Instruments.

Each licensee or registrant shall maintain records of the calibrations of its radiation survey instruments that are required under [12VAC5-481-1240](#) and retain each record for three years after it is made.

12VAC5-481-1420. Records of Leak Testing of Sealed Sources and Devices Containing Du.

Each licensee shall maintain records of leak test results for sealed sources and for devices containing DU. The results must be stated in units of becquerels (microcuries). The licensee shall retain each record for three years after it is made or until the source in storage is removed.

12VAC5-481-1430. Records of Quarterly Inventory.

A. Each licensee or registrant shall maintain records of the quarterly inventory of sources of radiation, including devices containing depleted uranium as required by [12VAC5-481-1260](#) , and retain each record for three years.

B. The record must include the date of the inventory, name of the individual conducting the inventory, radionuclide, number of becquerels (curies) or mass (for DU) in each device, location of sources of radiation and/or devices, and manufacturer, model, and serial number of each source of radiation and/or device, as appropriate.

12VAC5-481-1440. Utilization Logs.

A. Each licensee or registrant shall maintain utilization logs showing for each source of radiation the following information:

1. A description, including the make, model, and serial number of the radiation machine or the radiographic exposure device, transport, or storage container in which the sealed source is located;
2. The identity and signature of the radiographer to whom assigned;
3. The location and dates of use, including the dates removed and returned to storage; and
4. For permanent radiographic installations, the dates each radiation machine is energized.

B. The licensee or registrant shall retain the logs required by subsection A of this section for three years.

12VAC5-481-1450. Records of Inspection and Maintenance of Radiation Machines, Radiographic Exposure Devices, Transport and Storage Containers, Associated Equipment, Source Changers, and Survey Instruments.

A. Each licensee or registrant shall maintain records specified in [12VAC5-481-1270](#) of equipment problems found in daily checks and quarterly inspections of radiation machines, radiographic exposure devices, transport and storage containers, associated equipment, source changers, and survey instruments, and retain each record for three years after it is made.

B. The record must include the date of check or inspection, name of inspector, equipment involved, any problems found, and what repair and/or maintenance, if any, was performed.

12VAC5-481-1460. Records of Alarm System and Entrance Control Checks at Permanent Radiographic Installations.

Each licensee or registrant shall maintain records of alarm system and entrance control tests required by [12VAC5-481-1280](#) and retain each record for three years after it is made.

12VAC5-481-1470. Records of Training and Certification.

Each licensee or registrant shall maintain the following records for three years:

1. Records of training of each radiographer and each radiographer's assistant. The record must include radiographer certification documents and verification of certification status, copies of written tests, dates of oral and practical examinations, the names of individuals conducting and receiving the oral and practical examinations, and a list of items tested and the results of the oral and practical examinations; and
2. Records of annual refresher safety training and semi-annual inspections of job performance for each radiographer and each radiographer's assistant. The records must list the topics discussed during the refresher safety training, the dates the annual refresher safety training was conducted, and names of the instructors and attendees. For inspections of job performance, the records must also include a list showing the items checked and any noncompliance observed by the radiation safety officer or designee.

12VAC5-481-1480. Copies of Operating and Emergency Procedures.

Each licensee or registrant shall maintain a copy of current operating and emergency procedures until the agency terminates the license or registration. Superseded material must be retained for three years after the change is made.

12VAC5-481-1490. Records of Personnel Monitoring.

Each licensee or registrant shall maintain the following exposure records specified in [12VAC5-481-1350](#) :

1. Direct reading dosimeter readings and yearly operability checks required by [12VAC5-481-1350](#) B and [12VAC5-481-1350](#) C for three years after the record is made;
2. Records of alarming ratemeter calibrations for three years after the record is made;
3. Reports received from the film badge, OSL or TLD processor until the agency terminates the license or registration; and
4. Records of estimates of exposures as a result of off-scale personal direct reading dosimeters, or lost or damaged film badges, OSL or TLD's, until the agency terminates the license or registration.

12VAC5-481-1500. Records of Radiation Surveys.

Each licensee shall maintain a record of each exposure device survey conducted before the device is placed in storage as specified in subdivision 3 of [12VAC5-481-1360](#) . Each record must be maintained for three years after it is made.

12VAC5-481-1510. Form of Records.

Each record required by this part must be legible throughout the specified retention period. The record may be the original or a reproduced copy or a microform provided that the copy or microform is authenticated by authorized personnel and that the microform is capable of reproducing a clear copy throughout the required retention period. The record may also be

stored in electronic media with the capability for producing legible, accurate, and complete records during the required retention period. Records, such as letters, drawings, and specifications, must include all pertinent information, such as stamps, initials, and signatures. The licensee or registrant shall maintain adequate safeguards against tampering with and loss of records.

12VAC5-481-1520. Location of Documents and Records.

A. Each licensee or registrant shall maintain copies of records required by this part and other applicable parts of these regulations at the location specified in [12VAC5-481-1200](#) A 11.

B. Each licensee or registrant shall also maintain current copies of the following documents and records sufficient to demonstrate compliance at each applicable field station and each temporary jobsite;

1. The license or registration authorizing the use of sources of radiation;
2. A copy of Parts I ([12VAC5-481-10](#) et seq.); IV ([12VAC5-481-600](#) et seq.); V ([12VAC5-481-1170](#) et seq.); and X ([12VAC5-481-2250](#) et seq.) of this chapter;
3. Utilization logs for each source of radiation dispatched from that location as required by [12VAC5-481-1440](#) .
4. Records of equipment problems identified in daily checks of equipment as required by [12VAC5-481-1450](#) A;
5. Records of alarm system and entrance control checks required by [12VAC5-481-1460](#) , if applicable;
6. Records of dosimeter readings as required by [12VAC5-481-1490](#);
7. Operating and emergency procedures as required by [12VAC5-481-1480](#);
8. Evidence of the latest calibration of the radiation survey instruments in use at the site, as required by [12VAC5-481-1410](#);
9. Evidence of the latest calibrations of alarming ratemeters and operability checks of dosimeters as required by [12VAC5-481-1490](#);
10. Survey records as required by [12VAC5-481-1500](#) and [12VAC5-481-1000](#) as applicable, for the period of operation at the site;
11. The shipping papers for the transportation of radioactive materials required by Part XIII ([12VAC5-481-2950](#) et seq.) of this chapter; and
12. When operating under reciprocity pursuant to Part III ([12VAC5-481-380](#) et seq.) of this chapter, a copy of the applicable state license or registration, or NRC license authorizing the use of sources of radiation.

12VAC5-481-1530. Notifications.

Article 4. Notifications

A. In addition to the reporting requirements specified in [12VAC5-481-1110](#) and in Part IV ([12VAC5-481-600](#) et seq.) of this chapter, each licensee or registrant shall provide a written report to the agency within 30 days of the occurrence of any of the following incidents involving radiographic equipment:

1. Unintentional disconnection of the source assembly from the control cable;
2. Inability to retract the source assembly to its fully shielded position and secure it in this position;
3. Failure of any component, which is critical to safe operation of the device, to properly perform its intended function; or
4. An indicator on a radiation machine fails to show that radiation is being produced, an exposure switch fails to terminate production of radiation when turned to the off position, or a safety interlock fails to terminate X-ray production.

B. The licensee or registrant shall include the following information in each report submitted under subsection A of this section, and in each report of overexposure submitted under [12VAC5-481-1110](#) that involves failure of safety components of radiography equipment:

1. Description of the equipment problem;
2. Cause of each incident, if known;
3. Name of the manufacturer and model number of equipment involved in the incident;
4. Place, date, and time of the incident;
5. Actions taken to establish normal operations;
6. Corrective actions taken or planned to prevent recurrence; and
7. Names and qualifications of personnel involved in the incident.

C. Any licensee or registrant conducting radiographic operations or storing sources of radiation at any location not listed on the license or registration for a period in excess of 180 days in a calendar year shall notify the agency prior to exceeding the 180 days.

12VAC5-481-1540. (Repealed.)

Article 5. Jobsite Requirements

12VAC5-481-1550. (Repealed.)

12VAC5-481-1560. Reciprocity.

A. All reciprocal recognition of licenses and registrations by the agency will be granted in accordance with Part III ([12VAC5-481-380](#) et seq.) of this chapter.

B. Reciprocal recognition by the agency of an individual radiographer certification will be granted provided that:

1. The individual holds a valid certification in the appropriate category issued by a certifying entity, as defined in [12VAC5-481-10](#);
2. The requirements and procedures of the certifying entity issuing the certification affords the same or comparable certification standards as those afforded by [12VAC5-481-1320](#) A;
3. The applicant presents the certification to the agency prior to entry into the state; and
4. No escalated enforcement action is pending with the NRC or in any other agreement state.

C. Certified individuals who are granted reciprocity by the agency shall maintain the certification upon which the reciprocal recognition was granted, or prior to the expiration of such certification, shall meet the requirements of [12VAC5-481-1320](#) A.

12VAC5-481-1570. Specific Requirements for Radiographic Personnel Performing Industrial Radiography.

A. At a job site, the following shall be supplied by the licensee or registrant:

1. At least one operable, calibrated survey instrument for each exposure device or radiation machine in use;
2. A current whole body personnel monitor (TLD, OSL or film badge) for each person performing radiographic operations;
3. An operable, calibrated pocket dosimeter with a range of 0 to 2 mSv (200 mrem) for each person performing radiographic operations;
4. An operable, calibrated, alarming ratemeter for each person performing radiographic operations using a radiographic exposure device; and
5. The appropriate barrier ropes and signs.

B. Each radiographer at a job site shall have on their person a valid certification ID card issued by a certifying entity.

C. Industrial radiographic operations shall not be performed if any of the items in subsections A and B of this section are not available at the job site or are inoperable.

D. During an inspection, the agency may terminate an operation if any of the items in subsections A and B of this section are not available or operable, or if the required number of radiographic personnel are not present. Operations shall not be resumed until all required conditions are met.